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# Claims

[c1] A ferroelectric single crystal, consisting essentially of:
the potassium tantalate; and
the alkali metal or the group (V) metal;
said alkali metal substitutes for from about 1% to about 3% of the potassium, said group (V) metal substitutes for a part of the tantalum; and
said single crystal having cubic form of perovskite crystalline structure is essentially free of impurities and defects.

[c2] The single crystal according to claim 1, wherein said alkali metal is lithium, whereby forming a $K_{(0.97\ 0.99)}Li_{(0.03\ 0.01)}TaO_3$ composition.

[c3] The single crystal according to claim 1, wherein said group (V) metal is niobium, said niobium substituting of up to about 40% of tantalum, whereby forming a $KNb_{(0\ 0.4)}Ta_{(1\ 0.6)}O_3$ composition.

[c4] The single crystal according to claim 3, consisting of lithium substituting for up to 0.1% of potassium.

[c5] A method of production a ferroelectric single crystal consisting essentially of the potassium tantalate and the

alkali metal substituting from about 1% to about 3% of the potassium or the group (V) metal substituting in part for the tantalum, said single crystal having cubic form of perovskite crystalline structure is essentially free of impurities and defects comprising the steps of:

(a) providing the potassium precursor, a tantalum foil, and the alkali metal precursor or a group (V) metal foil;

(b) heating said tantalum foil in the oxygen, whereby synthesizing the tantalum oxide;

(c) if said group (V) metal required, heating said group (V) metal foil in the oxygen whereby synthesizing the group (V) metal oxide;

(d) creating a mixture of said potassium precursor, said tantalum oxide, and said alkali metal precursor or said group (V)metal oxide;

(e) heating said mixture in a crucible to obtain a melt;

(f) contacting a lower end of a seed crystal with a surface of said melt;

(g) lifting without rotation said seed crystal to grow a single crystal, wherein said crucible is not moved;

(h) separating the grown single crystal from said melt; and

(i) cooling said single crystal to the ambient temperature;

[c6] The method according to claim 5, wherein said potassium precursor is the potassium carbonate $K_2CO_3$.

[c7] The method according to claim 5, wherein said alkali metal precursor is the lithium carbonate $Li_2CO_3$.

[c8] The method according to claim 5, wherein said group (V) metal foil is a niobium foil.

[c9] A microwave resonator comprising the single crystal according to claim 1.

[c10] The microwave resonator according to claim 9, wherein, for frequencies from about 7GHz to about 15GHz, said single crystal has said $K_{(0.97 - 0.99)}Li_{(0.03\ 0.01)}TaO_3$ composition.

[c11] The microwave resonator according to claim 10, characterized by a shape substantially symmetrical relative to three mutually perpendicular planes and axes with a through hole along the longest of said axes.

[c12] The microwave resonator according to claim 9, wherein, for frequencies from about 60MHz to about 10GHz, said single crystal has said $KNb_{(0\ 0.4)}Ta_{(1\ 0.6)}O_3$ composition.

[c13] The microwave resonator according to claim 12, comprising biologically inert and a resonant frequency transparent coating and a holder for attaching said microwave resonator to a catheter.

[c14] The microwave resonator according to claim 12, characterized by a shape substantially symmetrical relative to three mutually perpendicular planes and axes with a through hole along one of said axes.

[c15] An EPR spectrometer with a rectangular cavity having opposing wide sides and narrow sides, a permanent magnet with planar poles disposed parallel and in close proximity to each of said wide sides, and a radio frequency AC generator with two connecting wires, comprising:
a ferroelectric single crystal resonator;
a through hole in said ferroelectric single crystal resonator;
a sample hole; and
two connection holes;
said sample hole and said connection holes are perpendicular to and through at least one of said narrow sides of said rectangular cavity, said ferroelectric single crystal resonator positioned within said rectangular cavity between said planar poles with said through hole perpendicular to said narrow sides, said sample hole is coaxial with said through hole, said connection holes are located in close proximity to said ferroelectric single crystal resonator at opposite sides of said sample hole, and said connecting wires are inserted in said connection holes.

[c16] The EPR spectrometer according to claim 15, wherein said ferroelectric single crystal resonator is a ferroelectric single crystal composed of $K_{(0.97\ 0.99)}Li_{(0.03\ 0.01)}TaO_3$, said ferroelectric single crystal having cubic form of perovskite crystalline structure is essentially free of impurities and defects.

[c17] The EPR spectrometer according to claim 16, wherein said ferroelectric single crystal resonator characterized by a shape substantially symmetrical relative to three mutually perpendicular planes and axes with the through hole along one of said axes.

[c18] A NMR spectrometer comprising:
a magnet forming a static homogeneous magnetic field;
a probe with means for transmitting a radio frequency magnetic pulse and detecting NMR signal;
a ferroelectric single crystal resonator; and
a through hole in said ferroelectric single crystal resonator.

[c19] The NMR spectrometer according to claim 18, wherein a resonant frequency of said ferroelectric single crystal resonator is effectively a multiple of the NMR spectrometer frequency.

[c20] The NMR spectrometer according to claim 18, wherein

said probe, said ferroelectric single crystal resonator, and said hole are substantially coaxial with said static homogeneous magnetic field axis.

[c21] The NMR spectrometer according to claim 18, wherein said ferroelectric single crystal resonator characterized by a shape substantially symmetrical relative to three mutually perpendicular planes and axes with the through hole along one of said axes.